



ELP and ESP Station Handout Grist Mill

INTRODUCTION

The goal of this handout is to prepare you to lead the Grist Mill station during your Environmental Living Program or Environmental Studies Program. At the Grist Mill station, your students will experience firsthand what it was like to grind wheat into flour using a hand-powered grist mill. This station will allow you and your students to explore the history, science, language, and math related to agriculture.

HISTORY

The Fort's primary crop was wheat and there were a number of fields near the Fort, so the grist mill had an important place at Sutter's Fort. The mill was likely in operation both day and night, and prior to the establishment of the Fort, the nearest grist mill was about 65 miles away in Sonoma. It was not until 1846, when a grist mill was opened, near present day Sloughhouse, that there was another local source for flour. The mill and agriculture were central to John Sutter's business plan for the Fort. He hoped create a thriving agricultural business. However, to be successful in agriculture, Sutter needed countless laborers. The large majority of those laborers were local California Indians.

Early visitors to the Fort, such as the French diplomat and dignitary Comte de Mofras, wrote glowingly about the limitless potential for agriculture at New Helvetia. The rich soil and the flat grasslands were an agricultural paradise to the trained eye. However, potential does not always translate into production; Sutter and the large California Indian workforce had many obstacles to overcome. The agricultural implements and tools were very crude. The standard for breaking ground was the "California Plow." This was a piece of iron attached to a piece of wood pulled behind an ox. The harvest tools, if available at all, consisted of barrel hoops, short blades, and split willow sticks. The California Indians often had to use their bare hands to harvest over 50,000 fenegas (80,000 bushels) of wheat. Can you imagine having to harvest wheat with your bare hands? In 1841, when Sutter purchased Fort Ross from the Russians, he acquired the tools and implements to supplement what little he had. These included manufactured steel plows, steel scythes, threshing floors, and winnowing machines. Even with these additional tools, the majority of laborers were still using what they had on hand.

Sutter used a process of turning wheat into flour that was common in Spain, Mexico, and South America, so many visitors to the Fort found it unusual. Here is a typical process used at Sutter's Fort:

1. The California Indian laborers harvested the wheat and bundled it for transport.
2. Then the laborers threshed the wheat to remove the seed head from the stalk and separate wheat berry from chaff. To do this, they lined the floor of the threshing corral,





outside the Southeast Bastion, with the wheat and chased a herd of mares around trampling the wheat.

3. Then the laborers had to winnow the wheat where they removed the fine chaff to leave just the edible wheat berry. To accomplish this, they carried the threshed wheat to the top bastion and laid down canvas, likely from sail cloth, outside the bastion. Then the laborers shoveled the threshed wheat out of the bastion windows, so the wind would blow the lighter chaff away and the heavier berry would fall down onto the canvas. Naturally, a windy day was a good day to winnow wheat, but laborers, also, could winnow small amounts of wheat in winnowing baskets.
4. Once the laborers had the wheat berry, they were ready to grind it into flour. They poured wheat berry into the hopper that loads wheat into the grinding stone. The grinding stone, or mill stone, consists of two individual stones between which the wheat is ground into flour. The bottom stone, called the bed stone, remains stationary. The top stone, called the runner stone, turns to grind the wheat. The stones force the wheat into the catch box aided by the furrow and land pattern carved into the stone. The laborers turned the runner stone via a wooden pole to which they harnessed a mule. They had to make sure the grinding was at a constant rate and not too fast. If they turned the stone too fast, the friction would create heat and would burn the flour. It was important for the miller to frequently bend over and sniff for the smell of burning flour, hence the saying "keep your nose to the grindstone."

Brief History of Bread

For centuries the staple food for China was (and is) rice, for the Americas it was corn and beans, and for the Mediterranean and mid-East regions it was wheat. In the early days of what was to become the United States, English colonists planted wheat in Jamestown, Virginia, but met with little success. They quickly changed to other crops such as corn, tobacco and cotton. Wheat was more of a hobby crop. George Washington grew wheat on his plantation and built a grist mill to process the wheat into flour.

- Ancients – Ground wild grains between flat stones, mixed the flour with water to make a flat bread similar to tortillas or pita.
- Egyptians – The first to use yeast as a rising (leavening) agent as early as 4,000 BC. They developed a consistent process for grinding.
- Greeks – Avid bakers who refined flours to eliminate impurities, and seasoned their breads with honey, seeds, nuts and fruits. They developed the stone oven for baking.
- Romans – Introduced "bread" to all the lands they conquered.





RUNNING THE GRIST MILL STATION

Place

The Fort's grist mill is in the Northwest corner of the Fort and so this is where you will set up your station for the day. The grist mill is in an enclosed area behind some walls and fencing and access is through a gap in the fence across which a rope can be drawn to keep out the general public. There is a small table and bench and while there is not much room in the area, you can bring in a few other small folding chairs if you feel you need it.

Items to Bring

The main thing you must bring on your ELP/ESP day is wheat berry. You can purchase wheat berry from a variety of natural food stores such as Whole Foods, Midtown Co-Op or Trader Joe's. The amount to bring depends on how many students you will have and how long you plan to have them grind. About 5 to 10 pounds is sufficient for one class.

Grist Mill Area Objects

- The main object is the grist mill itself. This consists of the bed stone (bottom stone) and runner stone (top stone), hopper (funnel), wooden lever and catch box. You will be working with this primary object.
- Other objects include the scythes and other harvesting tools hanging on the walls. You can show these to the students and demonstrate how they would be used but do not let the children handle the sharp tools.
- Baskets of wheat are sometimes hanging on the walls. You shouldn't take them down.
- Small buckets and brushes can be found in the green chest. These can be used during operation of the grist mill.
- Please ensure the children do not sit, climb or lean on the grist mill, the other mill stones, the brick wall, or any of the large items in the area.
- Make sure everyone respects the Fort and the artifacts.

Operating the Grist Mill

To operate the grist mill, you should put some wheat berry into the hopper and then walk around the grist mill while pushing the wooden lever. The grist mill must be turned **CLOCKWISE**. Please also remember: **DO NOT** turn the mill without wheat berry inside. If the mill is turned without grain inside, the stones will just grind against each other and wear down. As the wheat berry is ground, the flour will be pushed out from between the bed and runner stones and will fall into the catch box. You can then use the small brushes to sweep the flour towards the catch box exit on the East side where it can be swept into a bucket. Show the students the end product- the course ground flour. However, the flour is not for human consumption, so **DO NOT** let them taste or try to cook with the flour. Please also ensure they do not throw or dump the flour on the ground.





Clean Up

Sweep out all of the flour from the catch box and empty any remaining wheat berry from the hopper. The flour can simply be thrown away in the trash cans. Put all the things back into the green chest and on the walls. The ELP Evening Coordinator will lock the chest. Make sure the rest of the area is also cleaned up.

ADDITIONAL INFORMATION

Mathematics – weights and measures

Captain Sutter used a Spanish unit of volume for measuring wheat, the fenega. 1 fenega is equal to 1.6 bushels. One bushel of wheat yields enough whole wheat flour for 90 one-pound loaves of whole wheat bread. Below are additional conversions of weight and volume.

16 oz dry weight	=	1 pound	4 quarts	=	1 gallon
8 oz	=	1 cup	8 quarts	=	1 peck
2 cups	=	1 pint	4 pecks	=	1 bushel
2 pints	=	1 quart	1 bushel	=	32 quarts

Language

The following is a list of words and phrases related to grinding wheat and their definitions:

- Grindstone – Specially carved stones used to grind seeds into flour.
- Grist – A quantity of grain to be ground. It refers not only to wheat but also to grains such as oats, corn, rye, barley, etc.
- Flail – A tool that consists of a wooden staff with a short heavy stick swinging from it to beat the harvested grain and separate the kernel from the inedible chaff.
- Mill – A building equipped with machinery.
- Grist mill – A mill with machinery designed to grind grain into flour.
- Miller – A person who owns or operates a grist mill.
- Thresh – To separate the wheat kernel or berry from the inedible chaff by beating with a flail, etc. To beat severely. Straw or dried hay used for livestock or roof thatch.
- Wheat berry - Is the entire wheat kernel that, when ground, will produce whole wheat flour. The wheat kernel or berry is the seed of the wheat plant. Each tiny seed has three parts: the endosperm, the bran, and the germ.
- Flailing away – Swinging or waving about wildly.
- It's all grist for the mill – Everything can be made useful or be a source of profit.
- Keep your nose to the grindstone – If a grindstone is turned too fast it will build up heat and burn the flour. Millers frequently sniffed their grindstones to make sure the flour wasn't burning. So, this phrase refers to any hard, consistent work.





- Run of the mill – Undistinguished, ordinary, average. That is, the ordinary flour produced by a mill.
- Through the mill – To be exposed to hardship or rough treatment, just like grain being ground.
- To have a millstone around one's neck – To have a heavy weight of worry or work weighing one down.

Science and Agriculture

Wheat is a grass that is grown all over the world. It is a staple food that is ground into flour for bread, cereals, cookies, cakes, and pasta. More foods are made with wheat than any other cereal grain. It all begins with farming:

- Till (plow) the field.
- Sow the seeds.
- Water the plants.
- Harvest the crop, usually in June.
- Remove the stalk (straw) from the seed head.
- Thresh the wheat to separate the seeds from the chaff.
- Winnow to remove the seeds from the chaff.
- Grind the seeds into flour, but remember to save some seeds to plant next year.

Interesting Statistics

- One bushel of wheat weighs sixty (60) pounds and contains one million individual kernels.
- One bushel of wheat yields: 42 pounds of white flour which will make 70 one-pound loaves of white bread OR 60 pounds of whole wheat flour which will make 90 one-pound loaves
- In California, before the Gold Rush, flour cost about 1.5 cents per pound, during the Gold Rush about \$1.50 per pound.

